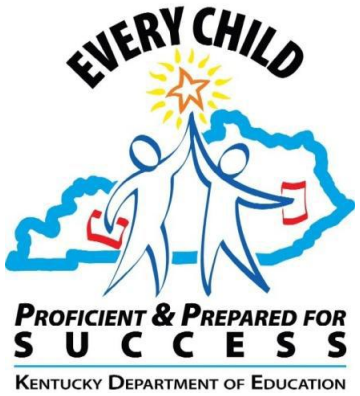
High School – Algebra 2

Kentucky Core Academic Standards with Targets
October 2011



Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard:	**N.CN.1 Know there is a complex number *i* such that $i^2 = -1$, and every complex number has the form a + b*i* with a and b real numbers.** **QualityCore C.1.a**
Domain:	**The Complex Number System**
Cluster:	**Perform arithmetic operations with complex numbers**
Type: __X____Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define *i* as $\sqrt{-1}$ or $i^2 = -1$. Define complex numbers. Write complex numbers in the form a + b*i* with a and b being real numbers.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**N.CN.2 Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.** **QualityCore: C.1.b**
Domain:	**The Complex Number System**
Cluster:	**Perform arithmetic operations with complex numbers**
Type: __X____Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Know that the commutative, associative, and distributive properties extend to the set of complex numbers over the operations of addition and multiplication. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard:	**N.CN.7 Solve quadratic equations with real coefficients that have complex solutions.** **QualityCore: E.1.c**
Domain:	**The Complex Number System**
Cluster:	**Use complex numbers in polynomial identities and equations**
Type: __X____Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Solve quadratic equations with real coefficients that have complex solutions. Note from Appendix A: Limit to polynomials with real coefficients.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**N.CN.8 (+) Extend polynomial identities to the complex numbers.** ***For example, rewrite $x^2 + 4$ as $(x + 2i)(x – 2i)$.*** **QualityCore:**
Domain:	**The Complex Number System**
Cluster:	**Use complex numbers in polynomial identities and equations**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Explain that an identity shows a relationship between two quantities, or expressions, that is true for all values of the variables, over a specified set. Give examples of polynomial identities. Note from Appendix A: Limit to polynomials with real coefficients.	Extend polynomial identities to the complex numbers. Note from Appendix A: Limit to polynomials with real coefficients		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**N.CN.9 (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.** **QualityCore:**
Domain:	**The Complex Number System**
Cluster:	**Use complex numbers in polynomial identities and equations**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
State, in written or verbal form, the Fundamental Theorem of Algebra. Note from Appendix A: Limit to polynomials with real coefficients.	Verify that the Fundamental Theorem of Algebra is true for second degree quadratic polynomials. Note from Appendix A: Limit to polynomials with real coefficients.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**A.SSE.1a Interpret expressions that represent a quantity in terms of its context.*(*Modeling standard)** **a. Interpret parts of an expression, such as terms, factors, and coefficients.** **QualityCore: A.SSE.1a and A.SSE.1b undergird many standards within the assessed QC conceptual areas, including, but not limited to: F.1.a, F.1.b, G.1.c**
Domain:	**Seeing Structure in Expressions**
Cluster:	**Interpret the structure of expressions**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
For expressions that represent a contextual quantity, define and recognize parts of an expression, such as terms, factors, and coefficients. Note from Appendix A: extend to polynomial & rational expressions	For expressions that represent a contextual quantity, interpret parts of an expression, such as terms, factors, and coefficients in terms of the context. Note from Appendix A: extend to polynomial & rational expressions		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**A.SSE.1b Interpret expressions that represent a quantity in terms of its context.*(Modeling standard)** **b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.*** **QualityCore: A.SSE.1a and A.SSE.1b undergird many standards within the assessed QC conceptual areas, including, but not limited to: F.1.a, F.1.b, G.1.c**
Domain:	**Seeing Structure in Expressions**
Cluster:	**Interpret the structure of expressions**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
The underpinning knowledge for this standard is addressed in **A.SSE.1a:** For expressions that represent a contextual quantity, define and recognize parts of an expression, such as terms, factors, and coefficients. Note from Appendix A: extend to polynomial and rational expressions	For expressions that represent a contextual quantity, interpret complicated expressions, in terms of the context, by viewing one or more of their parts as a single entity. Note from Appendix A: extend to polynomial and rational expressions		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**A.SSE.2 Use the structure of an expression to identify ways to rewrite it.** ***For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*** **QualityCore: A.SSE.2 undergirds many standards within the assessed QC conceptual areas, including but not limited to: C.1.b, C.1.c, F.1.a, F.1.b, G.1.c, G.1.e**
Domain:	**Seeing Structure in Expressions**
Cluster:	**Interpret the structure of expressions.**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify ways to rewrite expressions, such as difference of squares, factoring out a common monomial, regrouping, etc. Identify various structures of expressions (e.g. an exponential monomial multiplied by a scalar of the same base, difference of squares in terms other than just x) Note from Appendix A: Extend to polynomial and rational expressions.	Use the structure of an expression to identify ways to rewrite it. Classify expressions by structure and develop strategies to assist in classification (e.g. use of conjugates in rewriting rational expressions, usefulness of Pythagorean triples, etc.). Note from Appendix A: Extend to polynomial and rational expressions.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**A.SSE.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.**(Modeling standard) QualityCore: F.1.a, H.2.c, H.2.d, H.2.e (KCASM does not address finding the sum of an arithmetic series, exploration and derivation of the sum of an arithmetic series could occur in connection to a variety of standards, including an application of SMP 8)**
Domain:	**Seeing Structure in Expressions**
Cluster:	**Write expressions in equivalent forms to solve problems**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Find the first term in a geometric sequence given at least two other terms. Define a geometric series as a series with a constant ratio between successive terms. Use the formula $S = a\frac{(1-r^n)}{(1-r)}$ or an equivalent form to solve problems.	Derive a formula (i.e. equivalent to the formula $S = a\frac{(1-r^n)}{(1-r)}$) for the sum of a finite geometric series (when the common ratio is not 1). Note from Appendix A: Consider extending A.SSE.4 to infinite geometric series in curricular implementations of this course description.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**A.APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.** **QualityCore: F.1.a, F,1,b**
Domain:	**Arithmetic with Polynomial and Rational Expressions**
Cluster:	**Perform arithmetic operations on polynomials**
Type: ___X___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify that the sum, difference, or product of two polynomials will always be a polynomial, which means that polynomials are closed under the operations of addition, subtraction, and multiplication. Define "closure". Apply arithmetic operations of addition, subtraction, and multiplication to polynomials. Note from Appendix A: Algebra 2 should extend beyond the quadratic polynomials found in Algebra I.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**A.APR. 2 Know and apply the Remainder Theorem: For a polynomial *p*(*x*) and a number *a*, the remainder on division by *x* – *a* is *p*(*a*), so *p*(*a*) = 0 if and only if (*x* – *a*) is a factor of *p*(*x*).** **QualityCore: F.1.a, F.1.b, F.2.a, F.2.b, F.2.c**
Domain:	**Arithmetic with polynomials and rational expressions**
Cluster:	**Understand the relationship between zeros and factors of polynomials**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	**Reasoning Targets**	**Performance Skills Targets**	**Product Targets**
Define the remainder theorem for polynomial division and divide polynomials.	Given a polynomial p(x) and a number a, divide p(x) by (x – a) to find p(a) then apply the remainder theorem and conclude that p(x) is divisible by x – a if and only if p(a) = 0.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**A.APR.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.** **QualityCore: F.1.b, F.2.a, F.2.b, F.2.c, F.2.d**
Domain:	**Arithmetic with Polynomial and Rational Expressions**
Cluster:	**Understand the relationship between zeros and factors of polynomials**
Type: ___X___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
When suitable factorizations are available, factor polynomials using any available methods. Create a sign chart for a polynomial f(x) using the polynomial's x-intercepts and testing the domain intervals for which f(x) greater than and less than zero. Use the *x*-intercepts of a polynomial function and the sign chart to construct a rough graph of the function.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**A.APR.4 Prove polynomial identities and use them to describe numerical relationships.** ***For example, the polynomial identity*** $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ ***can be used to generate Pythagorean triples.*** **QualityCore: F.1.a (A component of this KCASM can be addressed through F.1.a, although the "proof" component is not addressed by any QC objectives.)**
Domain:	**Arithmetic with Polynomial and Rational Expressions**
Cluster:	**Use polynomial identities to solve problems**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Explain that an identity shows a relationship between two quantities, or expressions, that is true for all values of the variables, over a specified set.	Prove polynomial identities. Use polynomial identities to describe numerical relationships.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**A.APR.5 (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of *x* and *y* for a positive integer *n*, where *x* and *y* are any numbers, with coefficients determined for example by Pascal's Triangle.** **QualityCore: F.1.a**
Domain:	**Arithmetic with Polynomials and Rational Expressions**
Cluster:	**Use polynomial identities to solve problems**
Type: __X____Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define the Binomial Theorem and compute combinations. Apply the Binomial theorem to expand $(x+y)^n$, when *n* is a positive integer and *x* and *y* are any number, rather than expanding by multiplying.	Explain the connection between Pascal's Triangle and the determination of the coefficients in the expansion of $(x+y)^n$, when *n* is a positive integer and *x* and *y* are any number.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**A.APR.6 Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.** **QualityCore: F.1.b, G.1.e**
Domain:	**Arithmetic with Polynomials and Rational Expressions**
Cluster:	**Rewrite rational expressions**
Type: ___X___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Use inspection to rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$. Use long division to rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$. Use a computer algebra system to rewrite complicated rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**A.APR.7 (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.** **QualityCore: G.1.a, G.1.e**
Domain:	**Arithmetic with Polynomials and Rational Expressions**
Cluster:	**Rewrite rational expressions**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Add, subtract, multiply, and divide rational expressions.	Informally verify that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard with code:	**A.REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.** **QualityCore: G.1.a, G.1.b, G.1.c, G.1.d, G.1.e, G.1.f, G.1.g**
Domain:	**Reasoning with Equations and Inequalities**
Cluster:	**Understand solving equations as a process of reasoning and explain the reasoning**
Type: _____Knowledge __X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Determine the domain of a rational function. Determine the domain of a radical function. Solve radical equations in one variable. Solve rational equations in one variable.	Give examples showing how extraneous solutions may arise when solving rational and radical equations.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 1	
Standard:	**A.REI.11 Explain why the *x*-coordinates of the points where the graphs of the equations *y* = *f*(*x*) and *y* = *g*(*x*) intersect are the solutions of the equation *f*(*x*) = *g*(*x*); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where *f*(*x*) and/or *g*(*x*) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.*(*Modeling standard)** **QualityCore: E.1.d, F.2.a, F.2.b, F.2.d, (This KCASM connects to QC F.2.a, b, and d objectives if function *f(x)* or *g(x)* are defined as the zero polynomial) G.1.f, (A.REI.11 is an underpinning standard for QC D.2.a and E.2.c.)**
Domain:	**Reasoning with Equations and Inequalities**
Cluster:	**Represent and solve equations and inequalities graphically**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recognize and use function notation to represent linear, polynomial, rational, absolute value, exponential, and radical equations.	Explain why the x-coordinates of the points where the graph of the equations y=f(x) and y=g(x) intersect are the solutions of the equations f(x)=g(x). Approximate/find the solution(s) using an appropriate method for example, using technology to graph the functions, make tables of values or find successive approximations. Note from Appendix A: Include combinations of linear, polynomial, rational, radical, absolute value, and exponential functions.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit1	
Standard with code:	**F.IF.7c Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*(Modeling standard)** **c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.** **QualityCore: F.2.c, F.2.d**
Domain:	**Interpreting Functions**
Cluster:	**Analyze functions using different representations**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Graph polynomial functions, by hand in simple cases or using technology for more complicated cases, and show/label maxima and minima of the graph, identify zeros when suitable factorizations are available, and show end behavior. Notes from Appendix A: Relate F.IF.7c to the relationship between zeros of quadratic functions and their factored forms.	Determine the difference between simple and complicated polynomial functions, and know when the use of technology is appropriate. Relate the relationship between zeros of quadratic functions and their factored forms to the relationship between polynomial functions of degrees greater than two.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 2	
Standard with code:	**F.TF.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.** **QualityCore: G.3.b, G.3.c, G.3.g (While this standard does not make an explicit connection to degree measurement, there is a progression from KCASM G.C.5 towards F.TF.5 that this connection would strengthen, and then clearly connect to G.3.c).**
Domain:	**Trigonometric Functions**
Cluster:	**Extend the domain of trigonometric functions using the unit circle.**
Type: ___X___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	**Reasoning Targets**	**Performance Skills Targets**	**Product Targets**
Define a radian measure of an angle as the length of the arc on the unit circle subtended by the angle. Define terminal and initial side of an angle on the unit circle.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 2	
Standard with code:	**F.TF.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.** **QualityCore: G.3.b, G.3.c, G.3.g (While this standard does not make an explicit connection to degree measurement, there is a progression from KCASM G.C.5 towards F.TF.5 that this connection would strengthen, and then clearly connect to G.3.c).**
Domain:	**Trigonometric Functions**
Cluster:	**Extend the domain of trigonometric functions using the unit circle.**
Type: ___X___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Explain the relationship between a counterclockwise radian measure of an angle along the unit circle, terminal coordinate on the unit circle of that angle, and the associated real number. Explain how radian measures of angles of the unit circle in the coordinate plane enable the extension of trigonometric functions to all real numbers.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 2	
Standard with code:	**F.TF.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.*(*Modeling standard)** **QualityCore: G.3.c, G.3.d, G.3.g**
Domain:	**Trigonometric Functions**
Cluster:	**Model periodic phenomena with trigonometric functions**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define and recognize the amplitude, frequency, and midline parameters in a symbolic trigonometric function.	Interpret the parameters of a trigonometric function (amplitude, frequency, and midline) in the context of real-world situations. Explain why real-world or mathematical phenomena exhibits characteristics of periodicity. Choose trigonometric functions to model periodic phenomena for which the amplitude, frequency, and midline are already specified.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 2	
Standard with code:	**F.TF.8 Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin (θ), cos (θ), or tan (θ), given sin (θ), cos (θ), or tan (θ), and the quadrant of the angle.** **QualityCore:**
Domain:	**Trigonometric Functions**
Cluster:	**Prove and apply trigonometric identities**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define trigonometric ratios as related to the unit circle.	Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ Use the Pythagorean identity, $\sin^2(\theta) + \cos^2(\theta) = 1$, to find sin (θ), cos (θ), or tan (θ), given sin (θ), cos (θ), or tan (θ), and the quadrant of the angle.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 3	
Standard with code:	**A.CED.1 Create equations and inequalities in one variable and use them to solve problems.** ***Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*** **QualityCore: E.1.a, G.3.g, H.2.d, H.2.e (**(e.g. for $h(i) = i - 2,$ $\sum_{2}^{4} h(i) = (2-2)+(3-2)+(4-2)$ **).**
Domain:	**Creating Equations*(*Modeling Domain)**
Cluster:	**Create equations that describe numbers or relationships**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Solve all available types of equations & inequalities, including root equations & inequalities, in one variable. Describe the relationships between the quantities in the problem (for example, how the quantities are changing or growing with respect to each other); express these relationships using mathematical operations to create an appropriate equation or inequality to solve.	Create equations and inequalities in one variable and use them to solve problems. Create equations and inequalities in one variable to model real-world situations. Compare and contrast problems that can be solved by different types of equations. Note from Appendix A: Use all available types of functions to create such equations, including root functions, but constrain to simple cases.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 3	
Standard:	**A.CED.2 Create equations in two or more variables to represent relationships between quantities, graph equations on a coordinate axes with labels and scales.** **QualityCore: E.1.a, G.3.g, H.2.d, H.2.e (e.g. for** $h(i) = i - 2,$ $\sum_{2}^{4} h(i) = (2-2)+(3-2)+(4-2)$
Domain:	**Create Equations*(*Modeling Domain)**
Cluster:	**Create equations that describe numbers or relationships**
Type: _____Knowledge ____X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify the quantities in a mathematical problem or real-world situation that should be represented by distinct variables and describe what quantities the variables represent. Graph one or more created equation on a coordinate axes with appropriate labels and scales. Note from Appendix A: (While functions used in A.CED.2will often be linear, exponential, or quadratic the types of problems should draw from more complex situations than those addressed in Algebra I. For example, finding the equation of a line through a given point perpendicular to another line allows one to find the distance from a point to a line.)	Create at least two equations in two or more variables to represent relationships between quantities Justify which quantities in a mathematical problem or real-world situation are dependent and independent of one another and which operations represent those relationships. Determine appropriate units for the labels and scale of a graph depicting the relationship between equations created in two or more variables.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 3	
Standard with code:	**A.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.** ***For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*** **QualityCore: D.1.b, D.1.c, D.2.a, E.1.d, E.2.c, G.3.g**
Domain:	**Creating Equations* (*Modeling Domain)**
Cluster:	**Create equations that describe numbers or relationships**
Type: ___ __Knowledge ___X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recognize when a modeling context involves constraints. Note from Appendix A: While functions used will often be linear, exponential, or quadratic the types of problems should draw from more complex situations than those addressed in Algebra I. For example, finding the equation of a line through a given point perpendicular to another line allows one to find the distance from a point to a line.	Interpret solutions as viable or nonviable options in a modeling context. Determine when a problem should be represented by equations, inequalities, systems of equations and/ or inequalities. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities. Note from Appendix A: While functions used will often be linear, exponential, or quadratic the types of problems should draw from more complex situations than those addressed in Algebra I. For example, finding the equation of a line through a given point perpendicular to another line allows one to find the distance from a point to a line.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 3	
Standard:	**A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.** ***For example, rearrange Ohm's law V = IR to highlight resistance R.*** **QualityCore: This KCASM standard undergirds many standards within the assessed QC conceptual areas, including, but not limited to: F.1.a, G.1.a, G.1.g**
Domain:	**Creating Equations*(*Modeling Domain)**
Cluster:	**Create equations that describe numbers and relationships**
Type: _____Knowledge ___X__ Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define a "quantity of interest" to mean any numerical or algebraic quantity (e.g. $2\left(\frac{a}{b}\right) = d$, in which 2 is the quantity of interest showing that d must be even; $\frac{\pi r^2 h}{3} = V_{cone}$ and $\pi r^2 h = V_{cylinder}$ showing that $V_{cylinder} = 3 * V_{cone}$)	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (e.g. πr^2 can be re-written as $(\pi r)r$ which makes the form of this expression resemble bh. *The quantity of interest could also be* $(a+b)^n = a^n b^0 + a^{(n-1)}b^1 + \ldots + a^0 b^n$). Note from Appendix A: While functions used will often be linear, exponential, or quadratic the types of problems should draw from more complex situations than those addressed in Algebra I. For example, finding the equation of a line through a given point perpendicular to another line allows one to find the distance from a point to a line. Note that the example given for A.CED.4 applies to earlier instances of this standard, not to the current course.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/Course (HS): Algebra 2 Unit 3							
Standard with Code:	**F.IF.4** **For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* *(Modeling standard)** **QualityCore: G.3.e, G.3.f, G.3.g**						
Domain:	**Interpreting Functions**						
Cluster:	**Interpret functions that arise in applications in terms of the context.**						
Type: _____Knowledge __X__Reasoning ___ __Performance Skill _____Product							
Knowledge Targets		**Reasoning Targets**		**Performance Skill Targets**		**Product Targets**	
Define and recognize the key features in tables and graphs of linear, exponential, and quadratic functions: intercepts; intervals where the function is increasing, decreasing, positive, or negative, relative maximums and minimums, symmetries, end behavior and periodicity. Identify the type of function, given its table or graph. Notes from Appendix A: Emphasize the selection of a model function based on behavior of data and context.		Interpret key features of graphs and tables of functions in the terms of the contextual quantities the function represents. Sketch graphs showing key features of a function that models a relationship between two quantities from a given verbal description of the relationship. Notes from Appendix A: Emphasize the selection of a model function based on behavior of data and context.					
Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 3	
Standard with code:	**F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.** ***For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.****(*Modeling standard)** **QualityCore: C.1.d, E.2.a, F.2.d, G.3.e (these QC standards concern the determination of range, although F.IF.5 does not explicitly do so; range can be addressed by F.IF.4 or F.IF.5)**
Domain:	**Interpreting Functions**
Cluster:	**Interpret functions that arise in applications in terms of a context**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Given the graph or a verbal/written description of a function, identify and describe the domain of the function. Identify an appropriate domain based on the unit, quantity, and type of function it describes. Notes from Appendix A: Emphasize the selection of a model function based on behavior of data and context.	Relate the domain of the function to its graph and, where applicable, to the quantitative relationship it describes. Explain why a domain is appropriate for a given situation.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/Course (HS): Algebra 2 Unit 3							
Standard with Code:	**F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*(Modeling standard) QualityCore: (Interpreting functions throughout QC Algebra 2 course.)**						
Domain:	**Interpreting Functions**						
Cluster:	**Interpret functions that arise in applications in terms of a context**						
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product							
Knowledge Targets		**Reasoning Targets**		**Performance Skill Targets**		**Product Targets**	
Recognize slope as an average rate of change. Calculate the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. Note from the Appendix A: Emphasize the selection of a model function based on behavior of data and context.		Interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval.					
Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 3	
Standard with code:	**F.IF.7b Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*(Modeling standard)** **b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.** **QualityCore: E.2.b, F.2.b**
Domain:	**Interpreting Functions**
Cluster:	**Analyze functions using different representations**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions, by hand in simple cases or using technology for more complicated cases, and show/label key features of the graph. Note from the Appendix A: Focus on applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.	Analyze the difference between simple and complicated linear, quadratic, square root, cube root, and piecewise-defined functions, including step functions and absolute value functions and know when the use of technology is appropriate. Compare and contrast the domain and range of absolute value, step and piece-wise defined functions with linear, quadratic, and exponential. Select the appropriate type of function, taking into consideration the key features, domain, and range, to model a real-world situation.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 3	
Standard with code:	**F.IF.7e Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*(Modeling standard)** **e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.** **QualityCore: E.2.b, G.2.a, G.3.d, G.3.e, G.3.f**
Domain:	**Interpreting Functions**
Cluster:	**Analyze functions using different representations**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	**Reasoning Targets**	**Performance Skills Targets**	**Product Targets**
Graph exponential, logarithmic, and trigonometric functions, by hand in simple cases or using technology for more complicated cases, and show intercepts and end behavior for exponential and logarithmic functions, and for trigonometric functions, show period, midline, and amplitude. Note from the Appendix A: Focus on applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.	Analyze the difference between simple and complicated linear, quadratic, square root, cube root, piecewise-defined, exponential, logarithmic, and trigonometric functions, including step functions and absolute value functions and know when the use of technology is appropriate. Compare and contrast the domain and range of exponential, logarithmic, and trigonometric functions with linear, quadratic, absolute value, step and piece-wise defined functions. Select the appropriate type of function, taking into consideration the key features, domain, and range, to model a real-world situation.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 3	
Standard with code:	**F.IF.8a Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.** **a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.** **QualityCore: This KCASM standard undergirds many standards within the assessed QC conceptual areas, including, but not limited to: E.1.a, F.1.b, G.1.b, G.1.c, G.1.e**
Domain:	**Interpreting Functions**
Cluster:	**Analyze functions using different representations**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify how key features of a quadratic function relate to characteristics of in a real-world context.	Given the expression of a quadratic function, interpret zeros, extreme values, and symmetry of the graph in terms of a real-world context. Write a quadratic function defined by an expression in different but equivalent forms to reveal and explain different properties of the function and determine which form of the quadratic (i.e. expanded, perfect square form) is the most appropriate for showing zeros, extrema and symmetry of a graph in terms of a real-world context. Note from Appendix A: Focus on applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): HS Algebra 2 Unit 3	
Standard with code:	**F.IF.8b Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function:** **b. Use the properties of exponents to interpret expressions for exponential functions. *For example: identify percent rate of change in functions such as y= $(1.02)^t$, y=$(.97)^t$, y=$(1.01)^{12t}$, y=$(1.2)^{t/10}$, and classify them as representing exponential growth or decay.*** **QualityCore: E.1.a, F.1.b, G.1.b, G.1.c, G.1.e**
Domain:	**Interpreting Functions**
Cluster:	**Analyze functions using different representations**
Type: _____Knowledge ___X ___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify how key features of an exponential function relate to characteristics of in a real-world context.	Given the expression of an exponential function, use the properties of exponents to interpret the expression in terms of a real-world context. Write an exponential function defined by an expression in different but equivalent forms to reveal and explain different properties of the function, and determine which form of the function is the most appropriate for interpretation for a real-world context. Note from Appendix A: Focus on applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 3	
Standard with code:	**F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).** ***For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*** **QualityCore:**
Domain:	**Interpreting Functions**
Cluster:	**Analyze functions using different representations**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify types of functions based on verbal , numerical, algebraic, and graphical descriptions and state key properties (e.g. intercepts, maxima, minima, growth rates, average rates of change, and end behaviors) Differentiate between different types of functions using a variety of descriptors (graphically, verbally, numerically, and algebraically) Note from Appendix A: Focus on applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.	Use a variety of function representations (algebraically, graphically, numerically in tables, or by verbal descriptions) to compare and contrast properties of two functions		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 3	
Standard with code:	**F.BF.1b Write a function that describes a relationship between two quantities.*(Modeling standard)** **b. Combine standard function types using arithmetic operations.** ***For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*** **QualiltyCore: C.1.d, E.2.a (Determination of the domain and range of combined functions are not explicitly addressed by F.BF.1, but can be addressed by extending understanding from F.IF.5)**
Domain:	**Building Functions**
Cluster:	**Build a function that models a relationship between two quantities**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Combine two functions using the operations of addition, subtraction, multiplication, and division Evaluate the domain of the combined function. Note from Appendix A*:* Develop models for more complex or sophisticated situations than in previous courses.	Given a real-world situation or mathematical problem: • build standard functions to represent relevant relationships/ quantities • determine which arithmetic operation should be performed to build the appropriate combined function • relate the combined function to the context of the problem Note from Appendix A*:* Develop models for more complex or sophisticated situations than in previous courses.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 3	
Standard with code:	**F.BF.3 Identify the effect on the graph of replacing *f*(*x*) by *f*(*x*) + *k*, *k f*(*x*), *f*(*kx*), and *f*(*x* + *k*) for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*** **QualityCore: E.2.b, E.3.b (this QC standard only requires studying translations on circles and parabolas)**
Domain:	**Building Functions**
Cluster:	**Build new functions from existing functions**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Given a single transformation on a function (symbolic or graphic) identify the effect on the graph. Using technology, identify effects of single transformations on graphs of functions. Graph a given function by replacing *f*(*x*) by *f*(*x*) + *k*, *k f*(*x*), *f*(*kx*), and *f*(*x* + *k*) for specific values of *k* (both positive and negative). Note from Appendix A: Use transformations of functions to find models as students consider increasingly more complex situations. Note the effect of multiple transformations on a single graph and the common effect of each transformation across function types.	Describe the differences and similarities between a parent function and the transformed function. Find the value of k, given the graphs of a parent function, f(x), and the transformed function: f(x) + k, k f(x), f(kx), or f(x + k). Recognize even and odd functions from their graphs and from their equations. Experiment with cases and illustrate an explanation of the effects on the graph using technology.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 3	
Standard with code:	**F.BF. 4a Find the inverse functions** **a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. *For example:*** $f(x) = 2x^3$ ***or*** $f(x) = (x+1)/(x-1)$ ***for x ≠ 1.*** **QualityCore: This KCASM standard undergirds many standards within the assessed QC conceptual areas, including: G.2.b, H.2.b, H.2.d**
Domain:	**Building Functions**
Cluster:	**Building New Functions from Existing Functions**
Type: __X___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define inverse function. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. Note from Appendix A: Extend the set of functions to simple rational, simple radical and simple exponential functions; connect F.BF.4a to F.LE.4.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 3	
Standard with code:	**F.LE.4 For exponential models, express as a logarithm the solution to $a \cdot b^{ct} = d$, where a, b, and d are numbers and the base is 2, 10, or *e*; evaluate the logarithm using technology.** **QualityCore: G.2.b**
Domain:	**Linear and Exponential Models***
Cluster:	**Construct and compare linear and exponential models and solve problems.**
Type: ___ __Knowledge __X __Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recognize the laws and properties of logarithms, including change of base. Recognize and describe the key features logarithmic functions. Recognize and know the definition of logarithm base b. Evaluate a logarithm using technology.	For exponential models, express as a logarithm the solution to $a \cdot b^{ct} = d$, where a, b, and d are numbers and the base is 2, 10, or *e*.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/Course (HS): Algebra 2 Unit 4	
Standard with Code:	**S.ID.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. *Statistics and Probability is a Modeling Conceptual Category** **QualityCore:**
Domain:	**Interpreting Categorical and Quantitative Data*(Modeling Conceptual Category)**
Cluster:	**Summarize, represent, and interpret data on a single count or measurement variable.**

Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product

Knowledge Targets	Reasoning Targets	Performance Skill Targets	Product Targets
Describe the characteristics of a normal distribution. Use a calculator, spreadsheet, and table to estimate areas under the normal curve.	Use the mean and standard deviation of a data set to fit it to a normal distribution. Use a normal distribution to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. From Appendix A: While students may have heard of the normal distribution, it is unlikely that they will have prior experience using it to make specific estimates. Build on students' understanding of data distributions to help them see how the normal distribution uses area to make estimates of frequencies (which can be expressed as probabilities). Emphasize that only some data are well described by a normal distribution.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 4	
Standard with code:	**S.IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. *Statistics and Probability is a Modeling Conceptual Category** **QualityCore:**
Domain:	**Making Inferences and Justifying Conclusions*(Modeling Conceptual Category)**
Cluster:	**Understand and evaluate random processes underlying statistical experiments**
Type: ___X___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Explain that statistics is a process for making inferences about population parameters, or characteristics. Explain that statistical inferences about population characteristics are based on random samples from that population.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/Course (HS): Algebra 2 Unit 4							
Standard with Code:	**S.IC.2 Decide if a specified model is consistent with results from a given data-generating process, eg., using simulation.** ***For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*** ***Statistics and Probability is a Modeling Conceptual Category QualityCore:**						
Domain:	**Making Inferences and Justifying Conclusions*(Modeling Conceptual Category)**						
Cluster:	**Understand and evaluate random processes underlying statistical experiments**						
Type: _____Knowledge ___X__Reasoning _____Performance Skill _____Product							
Knowledge Targets		**Reasoning Targets**		**Performance Skill Targets**		**Product Targets**	
Use various, specified data-generating processes/models (e.g. computer models, physical recreations of experiments, etc.) Recognize data that various models produce. Identify data or discrepancies that provide the basis for rejecting a statistical model.		Decide if a specified model is consistent with results from a given data-generating process, eg., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model? From Appendix A: For S.IC.2, include comparing theoretical and empirical results to evaluate the effectiveness of a treatment.					
Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 4	
Standard with code:	**S.IC.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.** ***Statistics and Probability is a Modeling Conceptual Category** **QualityCore:**
Domain:	**Making Inferences and Justifying Conclusions*(Modeling Conceptual Category)**
Cluster:	**Make inferences and justify conclusions from sample surveys, experiments, and observational studies**
Type: ___X___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recognize the purpose of surveys, experiments, and observational studies in making statistical inferences and justifying conclusions and explain how randomization relates to each of these methods of data collection. Recognize the differences among surveys, experiments, and observational studies in making statistical inferences and justifying conclusions explain how randomization relates to each of these methods of data collection.	Note from Appendix A: In earlier grades, students are introduced to different ways of collecting data and use graphical displays and summary statistics to make comparisons. These ideas are revisited with a focus on how the way in which data is collected determines the scope and nature of the conclusions that can be drawn from that data. The concept of statistical significance is developed informally through simulation as meaning a result that is unlikely to have occurred solely as a result of random selection in sampling or random assignment in an experiment.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 4	
Standard with code:	**S.IC.4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.** ***Statistics and Probability is a Modeling Conceptual Category** **QualityCore:**
Domain:	**Making Inferences and Justifying Conclusions*(Modeling Conceptual Category)**
Cluster:	**Make inferences and justify conclusions from sample surveys, experiments, and observational studies**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define margin of error Explain the connection of margin of error to variation within a data set or population. Use a simulation model to generate data for random sampling, assuming certain population parameters/ characteristics.	Use data from a sample survey to estimate a population mean or proportion. Interpret the data generated by a simulation model for random sampling in terms of the context the simulation models. Develop a margin of error, assuming certain population parameters/ characteristics, through the use of simulation models for random sampling. From Appendix A: Focus on the variability of results from experiments—that is, focus on statistics as a way of dealing with, not eliminating, inherent randomness.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 4	
Standard with code:	**S.IC.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between two parameters are significant.** ***Statistics and Probability is a Modeling Conceptual Category** **QualityCore:**
Domain:	**Making Inferences and Justifying Conclusions*(Modeling Conceptual Category)**
Cluster:	**Making inferences and justify conclusions from sample surveys, experiments, and observational studies.**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Using an established level of significance, determine if the difference between two parameters is significant.	Use data from a randomized experiment to compare two treatments. Choose appropriate method to simulate a randomized experiment. Establish a reasonable level of significance. From Appendix A: Focus on the variability of results from experiments—that is, focus on statistics as a way of dealing with, not eliminating, inherent randomness.		

Make sense of problems and persevere in solving them.	Reason quantitatively and abstractly	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 4	
Standard with code:	**S.IC.6 Evaluate reports based on data. * *Statistics and Probability is a Modeling Conceptual Category QualityCore:**
Domain:	**Making Inferences and Justifying Conclusions**
Cluster:	**Make inferences and justify conclusions from sample surveys, experiments, and observational studies**
Type: _____Knowledge ____X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define the characteristics of experimental design (control, randomization, and replication).	Evaluate the experimental study design, how the data was gathered, what analysis (numerical or graphical) was used (ex: use of randomization, control, replication). Draw conclusions based on graphical and numerical summaries. Support with graphical and numerical summaries how "appropriate" the report of data was (ex: consider the existence of outliers, correlation coefficient with both linear and non-linear data, margin of error).		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 4	
Standard with code:	**S.MD.6 (+) Use probabilities to make fair decisions (e.g. drawing by lots, using a random number generator.)** ***Statistics and Probability is a Modeling Conceptual Category** **QualityCore: All components of QC Section H can be applied to both MD standards.**
Domain:	**Using Probability to Make Decisions*(Modeling Conceptual Category)**
Cluster:	**Use probability to evaluate outcomes of decisions**
Type: _____Knowledge ____X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recall previous understandings of probability.	Use probabilities to make fair decisions (e.g. drawing by lots, using a random number generator.) From Appendix A: Extend to more complex probability models. Include situations such as those involving quality control, or diagnostic tests that yield both false positive and false negative results.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

Grade Level/ Course (HS): Algebra 2 Unit 4	
Standard with code:	**S.MD.7 (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game.)** ***Statistics and Probability is a Modeling Conceptual Category** **QualityCore: All components of QC Section H can be applied to both MD standards.**
Domain:	**Using Probability to Make Decisions*(Modeling Conceptual Category)**
Cluster:	**Use probability to evaluate outcomes of decisions**
Type: _____Knowledge __X____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recall previous understandings of probability.	Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). From Appendix A: Extend to more complex probability models. Include situations such as those involving quality control, or diagnostic tests that yield both false positive and false negative results.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.